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XII. *Some Observations on the Parts of Fructification in Mosses ; with Characters and Descriptions of Two New Genera of that Order.* By Mr. Robert Brown, Lib. Linn. Soc.

*Read June 20th, 1809.*

THE account which the celebrated Hedwig has given of the sexes of Mosses, seems to be founded on so ample an induction, and is now so generally received, that it must be necessary to notice the arguments which mere theoretical Botanists have from time to time produced against it. There is, however, one author, Mons. Palisot Beauvois, who has not only objected to the account of Hedwig, but has proposed a theory of his own, and who consequently appealing to actual observations, and appearing to have particularly studied, specifically at least, this tribe of plants, merits some attention. The earliest account of Mons. Beauvois' theory is to be found in the observations added to the order Musci in the *Genera Plantarum* of Jussieu ; and it was soon after more fully given by the author himself, in a *Memoir* on the Sexual Organs of Mosses, published in the third volume of the *American Philosophical Transactions* : since that time he has in his different works occasionally treated of the same subject, and has lately repeated the substance of his original essay, in the introduction to his "*Prodrome de Cinquieme et Sixieme Familles de l'Æthiogamie*," published at Paris in 1805, a translation of which is given by my friend Mr. König, in the second volume of the *Annals of Botany*. To this work, as it must  
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be in the hand of every scientific botanist, I refer for a full account of M. Beauvois' hypothesis, and confine myself to observing, that what is generally called the capsule of Mosses is by him considered as the containing organ of both sexes; that the granules which Hedwig supposes to be seeds, he regards as pollen; the real seeds according to him being imbedded in the substance of that body which occupies the centre of the capsule, and to which botanists have given the name of *columnula* or *columella*. The supposed seeds of this author, however, having entirely escaped the two most acute and experienced observers in this department of botany, Schmidel and Hedwig, in all the species of which they have given dissections, it might fairly be concluded that they are not of universal existence, and this alone would be sufficient perhaps to overturn the hypothesis. But it would be more satisfactory, if, while the accuracy of these excellent observers was confirmed in other instances, the cause of that appearance, which I apprehend has misled M. Beauvois, could at the same time be pointed out. The species more particularly described and figured by him in the American Transactions, is *Hypnum velutinum*; which therefore, had it been in a proper state, I should have preferred as the subject of my examination; but as he asserts that his observations were repeated, and with similar results, on all the species of Mosses found in the neighbourhood of Paris and Lisle, I have chosen *Funaria hygrometrica*, perhaps the most general plant in existence; which therefore must have been examined by him, and is within the reach of every one.

As, according to M. Beauvois, the action of the pollen on the seeds does not take place till the separation of the operculum, he probably did not conceive it necessary to observe the capsule until it had acquired its full size, and was in fact nearly ripe,  
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or, as he terms it, in blossom. At this period he examined under the microscope a transverse section of the capsule, in which, as appears both from his description and figure, he found a dense stratum of granular matter, which he considered to be pollen, situated immediately within the inner membrane; while in the substance occupying the centre, which he describes as reticulated, he observed scattered granules, in size and appearance like those of the pollen already mentioned: these he regards as the genuine seeds, and the containing organ he calls the capsule.

It is remarkable that he no where expressly states the manner in which this capsule bursts: but it may be inferred, from the use he assigns to the peristomium, that he supposes it to eject its contents by the upper extremity: for, if the bursting were lateral, the seeds would at once come into contact with the pollen: but though impregnation would in this way more certainly be accomplished, the motions of the ciliæ could no longer be considered as in any degree assisting it.

Desirous to examine an object as nearly similar as possible to that on which the hypothesis appears to be founded, I in the first place made a transverse section of the full grown but green capsule of *Funaria hygrometrica*; and, I confess, was both surprised and disappointed to find it, under the microscope, exactly resembling M. Beauvois' figure [18]. But little reflection, however, was necessary to show that these scattered granules might either have been forced into the pulpy central substance, by the pressure necessarily applied to the stratum of pollen in making the section, or, what is more probable, been carried over its surface by the cutting instrument, which had previously passed through this stratum. Accordingly, by repeated immersion in water, and more readily still by the careful application of a small hair pencil,

pencil, the greater part of the granules was removed. A transverse section at an earlier stage of the capsule, before the falling of the calyptra, exhibited, as I expected, fewer granules on the substance of the columella, and which were removeable in like manner. Lastly, by a longitudinal section, in which, if well performed, the scalpel could not be supposed to carry any part of the pollen over the surface of the columella, I obtained a distinct view of this part, perfectly free from these supposed seeds, and evidently consisting of large cells filled with an uniform pulpy substance; a continuation of which occupied the cavity of the operculum.

From these observations, even added to those of Schmidel and Hedwig, though they seem conclusive against the hypothesis of M. Beauvois, I by no means pretend to reason strictly respecting the whole order: on the contrary, from the conversations I have had with my ingenious and accurate friend Mr. Francis Bauer, as well as from some observations of my own, I am disposed to believe that considerable diversities may exist in the placentation of Mosses: that in some cases the seeds may be formed in a much greater portion of the columnula than in others: and it is even not improbable that in certain cases its whole substance may be converted into seeds; or, to speak more accurately, that it may produce seeds even to the centre, and that the cells in which they were probably formed may be re-absorbed. This I am inclined to think is the case in *Phascum alternifolium* of Dickson, in the ripe capsule of which there is hardly the vestige of a columnula; and I have observed the same structure in two new species of *Anodontium* of Bridel; which, if it equally exists in the only species of this genus hitherto described, would perhaps considerably strengthen its character. In these cases the inner membrane is also evanescent; and such  
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a structure, it may be remarked, equally militates against M. Beauvois' theory, whether we suppose the columella to have existed at an earlier stage, in the usual form, or not.

As to this organ being tubular, and discharging its contents by the top, it is neither consistent with what has been already observed, nor with the appearance of its remains in the ripe capsule: but admitting for a moment its tubular nature, there are certain Mosses in which no discharge could possibly take place in the way described; the column being elongated even to the apex of the operculum, to which it often continues to adhere, as in *Buabaumia*, and in the first of the two new genera which I now proceed to describe.

## DAWSONIA.

*Peristomium* penicillatum, ciliis numerosissimis capillaribus rectis æqualibus e capsulæ parietibus columellæque (!) ortis.

*Capsula* hinc plana, indè convexa.

*Calyptra exterior* e villis implexis, *interior* apice scabra.

*Muscus* hinc arctè affinis *Polytricho*, quo cum foliis, floribus masculis, et calyptrâ penitus convenit; indè, aliquo modo. *Buxbaumia* accedens, præsertim figurâ capsulæ, et structurâ columellæ. *Peristomio* autem ab omnibus diversissimus.

## DAWSONIA POLYTRICHOIDES.

### TAB. XXIII. Fig. 1.

**PATRIA.** Novæ Hollandiæ ora orientalis, extra tropicum.

**STATIO.** Ripæ subumbrosæ rivulorum, ad radices montium, in vicinitate Portûs Jackson.

**DESC.** *Cæspites* laxi, amorphi. *Radiculæ* tenuissimæ, tomenti instar



instar caudicem descendentem brevem investientes. *Caulis* simplicissimus, erectus, strictus, 2—3-uncialis, basi reliquiis foliorum squamatus, suprâ densè foliatus. *Folia*, e basi dilatâ semiamplexicauli membranaceâ fuscâ, lineari-subulata, opaca, viridia, marginibus longitudinaliter dorsoque apicis denticulatis, spinulis sursum crebrioribus majoribusque, concaviuscula, patula, siccatione appressa, canaliculata, superiora vix semuncialia, inferiora sensim breviora.

*Masculi Flores* terminales, discoidei. *Folia perigonia* cuneato-orbiculata, mucronata, integerrima, semiimembranacea, exteriora sensim majora. *Fila succulenta* numerosa, articulata, basi attenuata. *Antheræ* flosculi singuli 6—8, cylindraccæ, brevissimè pedicellatæ.

*Femineus Flos* in distincto individuo. *Seta* terminalis, solitaria, erecta, lævis, nitens, rufo-fusca, caule ter brevior, foliis terminalibus duplò longior. *Vaginula* cylindracea, stricta, glabra, tegmine pilorum calyptræ exterioris instar instructa.

*Calyptra* duplex: *exterior* constans pilis intertextis dimidio inferiore tenui flexuoso pallido ramuloso edentulo, superiore ferrugineo stricto denticulato: *interior* membranacea straminea, capsulæ maturæ subulata, suprâ longitudinaliter fissa, apice solùm denticulata.

*Capsula* nutans, angulum ferè rectum cum setâ efformans, ovata, per lentem reticulata, arcolis subrotundis, sordidè fusca, lævis, nonnitens, suprâ plana marginibus acutis, subtùs modicè convexa ore coarctato, marginato. Apophysis nulla.

*Operculum* conico-cylindraceum, capsulâ brevius, apice lateris superioris in mucrone levissimè incurvum producto, basi incrassatâ, cum calyptris sæpissimè deciduum.

*Peristomium* penicillum densum album referens, longitudine circiter dimidii capsulæ, formatum *Ciliis* indeterminatim nu-

merosissimis (200 et ultra) capillaribus inarticulatis æqualibus rectis albis opacis, pluribus e capsulæ parietibus ortum ducentibus, centralibus (circiter 50) columellam terminantibus!

*Membrana interior* capsulæ maturæ exteriori approximata, vasculisque numerosis connexa.

*Columella* longitudine capsulæ maturæ, in quâ latiuscula, corrugata, colli brevis margine incrassatâ, intra ciliis desinens in processum filiformem solidum indivisum apicem operculi attingentem eique arctius adhærentem.

*Semina* minutissima, lævia, in cumulo viridia, seorsum hyalina.

Obs. I. I have named this remarkable genus in honour of my esteemed friend DAWSON TURNER, Esq., a gentleman eminently distinguished in every part of Cryptogamic botany, and from whom, after he has finished the incomparable work on *Fuci*, in which he is now engaged, we may expect a general history of Mosses.

Obs. II. The strict relationship between *Dawsonia* and *Polytrichum* in most respects, and the striking dissimilarity of their peristomiums, may tend, perhaps, in some degree to lessen our confidence in the characters derived from that part; for there seems in this case but little analogy between the two structures. The better to understand that of *Polytrichum*, I was induced along with Mr. Turner to examine it in the unripe capsule: in this state the cavity of the operculum was found completely filled with a cellular pulp, similar to that composing the columella, of which it appeared evidently to be a continuation: to the surface of this pulp the teeth of the peristomium were closely pressed, but did not adhere: by degrees the pulp dries up, and in the ripe capsule leaves only the membrane or tympanum of an inorganic appearance, and  
firmly

firmly cohering with the teeth by the inner side of their apices. It does not therefore properly belong to the operculum, though in some cases it may adhere to it, as does the analogous process of the columella in *Dawsonia* and in several other Mosses.

The affinity of *Dawsonia* to *Buxbaumia* is certainly less strict than to *Polytrichum*, and rests chiefly on the similarity of the figure of the capsule, and in the central process of the columella, which is still more evident in *Buxbaumia*, where it forms part of the Linnean generic character, though unaccountably overlooked by Schmidel in his masterly dissertation; but, if I mistake not, actually represented by him [in fig. 14, b, *l. c.*], and confounded with the peristomium, which in this case, I suppose, had adhered to the operculum, as I have repeatedly found it to do, and thus escaped his notice. Hedwig considers the plaited membrane which constitutes the peristomium of *Buxbaumia*, as derived from the inner membrane of the capsule, and quotes the figure just mentioned of Schmidel in proof of this origin. In both species, however, I find it arising from the exterior membrane, though considerably within its margin, which in *Buxbaumia aphylla* is said by Hedwig to be divided into teeth,—an appearance I could not observe in the few ripe capsules I have dissected. In other respects, the two species seem essentially to agree, and therefore ought not to be separated, as Ehrhart and some late writers have done. The generic character comprehending both, I would propose to alter in the following manner.

# BUXBAUMIA.

*Capsula* obliqua, hinc convexior, v. gibba.

*Peristomium* intra marginem, quandoque dentatum, membranæ exterioris ortum, tubulosum, plicatum, apice apertum.



## LEPTOSTOMUM.

*Capsula* oblonga, exsulca; *Operculo* hemisphærico, mutico.

*Peristomium* simplex, membranaceum, annulare, planum, indivisum, e membranâ interiori ortum.

*Musci* densè cæspitosi. *Caules erecti, annotino-ramosi. Folia undique modicè patentia, latiuscula, nervo valido, marginibus integris, revolutis, pilo (quandoque ramoso?) terminata. Seta terminalis. Capsula erecta, v. inclinans, basi in apophysin obconicam attenuata, ore coarctato. Calyptra glabra, lævis, caduca.*

1. *L. inclinans*, foliis ovato-oblongis obtusis; pilo simplici, capsulis inclinatis obovato-oblongis.

TAB. XXIII. *Fig. 2.*

*PATRIA.* Insula Van-Diemen.

*STATIO.* Rupes et saxa ad latus orientale prope summitatem Montis Tabularis Lat. Aust. 43°, elevatione supra mare 3000 ad 3500 ped.

*DESC.* Muscus lætè virens 2—3-uncialis. Caules parùm divisi, infrà tomento denso ferrugineo vestiti, suprà confertim foliati. Folia concaviuscula per lentem minutissimè punctato-arcolata, pilo tortili ipso folio quater brevior. Seta fusca, lævis. Vaginula infrà stipata adductoribus pluribus filisque succulentis capillaribus articulatis.

2. *L. erectum*, foliis oblongo-parabolicis obtusis; pilo simplici, capsulis erectis oblongis.

*PATRIA.* Novæ Hollandiæ ora orientalis, extra tropicum.

*STATIO.* Rupes prope fluviorum ripas, in regione montanâ; ad fluvios Hawkesbury et Grose.

*DESC.* Muscus 2—3-uncialis. Caules simplices et subramosi, infrà

infra tomento ferrugineo vestiti, suprà densè foliati. Folia siccatione parùm curvata et simul adpressa. Seta elongata, fusca, lævis. Capsula æquilatera. Operculum delapsum fuit.

3. *L. gracile*, foliis ovato-oblongis acutiusculis; pilo simplici folii dimidium æquante, capsulis oblongis æquilateris inclinatis.

PATRIA. Nova Zelandia.

STATIO. Umbrosa humida (?) ad Dusky Bay. *Dom. Arch. Menzies.*

DESC. Caules subramosi. Folia siccatione adpressa, areolato-punctata. Seta elongata, lævis. Vaginula cylindracea, filis succosis adductoribusque numerosis cincta.

4. *L. Menziesii*, foliis oblongo-lanceolatis acutis; pilo simplici folio quater brevior, capsulis oblongis inclinatis arcuato-recurvis.

PATRIA. Americæ Australis Staten-Land, ubi anno 1787 detexit *Dom. Arch. Menzies*, cujus amicitiae hanc et præcedentem speciem debeo.

STATIO. -----

DESC. Muscus lætè virens, sesquiuncialis. Caules subsimplices, basi ferrugineo-tomentosi, suprà confertim foliati. Folia erecto-patentia, siccatione adpressa, minutissimè areolata, v. punctata. Seta caulem sæpiùs superans, erecta, fusca, lævis. Capsula subfalcata ad angulum acutum rariusve ferè rectum inclinans.

Obs. The plants which I have referred to this genus are all natives of the southern hemisphere, and in their habit, in which there is something peculiar, strictly agree with each other, and with *Bryum macrocarpum* of Hedwig. In three  
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of the four species here described, I have had the opportunity of removing the operculum without having been able in any case to observe an external peristomium, which, from the appearance of these plants, might be expected to exist, and which Hedwig has figured in his *Bryum macrocarpum*. Of this plant I have only seen specimens that had lost the operculum: the mouth of the capsule, however, seemed to be very perfect, and was furnished with a membrane, exactly as in the species here described, but I could not perceive any remains of external teeth. In opposition to such authority, however, I do not venture to add it to this genus, to which in every other respect it seems to belong.

The character of *Leptostomum*, derived from the undivided annular process of the inner membrane of the capsule, may to many appear too minute, and perhaps unimportant; and had it been observed in one species alone, I should not have ventured on that account to distinguish it as a genus: but finding it in four species, accompanied too with a habit widely different from that of *Gymnostomum*, to which these plants must otherwise be referred, I have not hesitated to employ it. As, however, Hedwig has actually figured and described an external peristomium in his *Bryum macrocarpum*, whose striking resemblance to *Leptostomum* has been already noticed, there may be still some reason to doubt the sufficiency of the generic character, and it may seem somewhat improbable that Mosses of such a habit should be really destitute of an outer peristomium. But, without questioning the accuracy of Hedwig in this instance, I may be permitted to observe, that the outer peristomium which he has figured in *Bryum macrocarpum* is extremely unlike that of any other genus where the fringe is double:  
and

and it may perhaps in some degree tend to strengthen the character of *Leptostomum*, to advert to what appears to be really the case in certain species of *Pterogonium*, in one of which\* Mr. Hooker has already described the fringe as derived solely from the inner membrane; and I have collected, on the mountains of Van Diemen's Island, a moss with a peristomium decidedly of like origin; a circumstance that appeared to me so remarkable, that I had actually described it as a distinct genus, before I was aware of the similar structure of the Nepal plant described by Mr. Hooker; or of the probability, from Hedwig's own figures, that some at least of his *Pterogonia* were of the same structure; a point that I have not at present the means of determining, but which I beg leave to recommend to the attention of those botanists who are provided with perfect specimens of the published *Pterogonia*.

### EXPLICATIO TABULÆ XXIII.

*Fig. 1.* Dawsonia polytrichoides. *a.* Mascula planta magnitudine naturali. *b.* Discus masc. auctus. *c.* Ejusdem flos unicus. *d.* Idem absque folio perigoniali, magisque auctus. *e.* Anthera et filum succulentum maximè aucta. *f.* Femiinæ plantæ magn. nat. *g.* Vaginula cum foliis perichætialibus auctis. *h.* Capsula cum calyptra exteriori. *i.* Pili calyptræ exterioris magis aucti. *j.* Capsula cum operculo et calyptrâ interiori. *k. l.* Capsula deoperculata cum peristomio. *m.* Capsulæ sectio ejusdem figuram insertionemque ciliarum ostendens. *o.* Calyptra interior. *p.* Operculum cum colu-

\* *Pterogonium declinatum.* *Trans. Linn. Soc.* ix. p. 309.

mellæ processu filiformi. *q.* Columella ciliis suis terminata.  
*r.* Semina. *s.* Ciliæ peristomii auctæ.

*Fig. 2.* *Leptostomum inclinans* magnitudine naturali. *α.* Ejusdem capsula aucta cum membranâ annulari. *β.* Operculum.  
*γ.* Idem a basi visum cum annulo cohærenti.